Infected carotid pseudoaneurysm and carotid-cutaneous fistula as a late complication of carotid artery stenting

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Carotid stenosis after neck irradiation is a well-described entity. A 78-year-old man presented with left eye amaurosis fugax 11 years after radical neck dissection and neck irradiation for mucoepidermoid carcinoma. The patient underwent carotid artery stenting for a high-grade stenosis of the left internal carotid artery. Twenty months after the procedure, a pulsatile neck mass developed with intermittent arterial bleeding. After control of the bleeding, he underwent resection of the left carotid bifurcation, including the indwelling stent and reconstruction with a saphenous vein interposition graft. A pectoralis myocutaneous flap was used for wound closure. In this case, localized infection of the stented carotid artery led to mycotic degeneration, pseudoaneurysm formation, and erosion to the skin surface. As carotid artery stenting becomes more widely used, previously unreported late complications associated with this procedure are likely to become apparent, and continued close follow-up is warranted. (J Vasc Surg 2006;43:379-82.)

Carotid stenosis is a major sequela of head and neck irradiation after radical neck dissection for cancer.[1-3] The surgical management of carotid artery stenosis in this setting has been shown to be safe and durable, albeit technically demanding.[4,5] Severe scarring and fibrosis in the irradiated field may be associated with an increase in wound complications and inadvertent cranial nerve injury. Recent results of carotid artery stenting (CAS) for symptomatic carotid stenosis in high-risk patients have been promising, with perioperative morbidity comparable with carotid endarterectomy.[6]

In patients with a history of radiotherapy, CAS is particularly promising because it eliminates the need for an incision in the irradiated field as well as extensive dissection and vascular mobilization. Several small series have reported successful CAS in patients with a history of radiotherapy.[7,8] These reports have indicated a low perioperative complication rate. However, long-term follow-up is lacking in this cohort of patients. We report a case in which 20 months after successful CAS, a carotid-cutaneous fistula resulted in pulsatile bleeding from the neck that necessitated emergent intervention and surgical reconstruction.

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CASE REPORT

A 78-year-old man presented with two episodes of left eye amaurosis fugax. Eleven years earlier, he had undergone left radical neck dissection for mucoepidermoid carcinoma of the oropharynx followed by neck irradiation. Neither the dosage nor the duration of radiotherapy was known, but the physical examination revealed a firm, woody neck with minimal soft tissue and a prominent left-sided carotid bruit. A carotid duplex scan was significant for an >80% stenosis of the left internal carotid artery (LICA), which was confirmed on angiography at the time of intervention (Fig 1).

The patient underwent LICA stenting with cerebral protection for this high-grade, symptomatic lesion. A 5F diagnostic JR4 catheter (Merit Medical, South Jordan, Utah) was advanced into the left external carotid artery over a floppy angled Glidewire (Guidant Corp, Indianapolis, Ind) using roadmapping guidance. The angled Glidewire was then exchanged for a stiff 6-cm-tip Amplatz wire, followed by removal of the JR4 catheter. An 8F 70-cm Rabbe sheath (Cook, Bloomfield, Ind) was then advanced into the distal left common carotid artery. After predilation of the high-grade LICA lesion with a 5-mm coronary balloon, a Med-Nova filter (MedNova, Inc, Galway, Ireland) was passed through the LICA lesion followed by deployment of a 8- × 20-mm Precise stent (Cordis Endovascular, New Brunswick, NJ), achieving a satisfactory technical result. Perioperative antibiotics were not administered during this procedure.

The patient was discharged within 24 hours, and was symptom-free during office visits at 1, 3, and 6 months postoperatively, with a patent stented segment on carotid duplex. Twenty months after the procedure, however, a pulsatile mass developed in the patient's left neck with some purulent drainage. He did not seek medical attention until a week later, when he presented to the emergency

Fig 1. Selective left carotid arteriography before carotid artery stenting reveals a high-grade carotid bifurcation stenosis in a patient with amaurosis fugax.

Fig 2. Photograph of the patient's left neck 20 months after carotid artery stenting. A pulsatile mass developed in the patient's left neck, with bleeding from an area of recent skin breakdown. Note that the patient had undergone radical neck dissection followed by neck irradiation for carcinoma of the oropharynx many years previously and had an indurated and fibrotic neck.

department with sudden onset of pulsatile bleeding from an area of recent skin breakdown in the left neck (Fig 2).

An arteriogram revealed two small pseudoaneurysms with active extravasation of contrast in the proximal external carotid artery. The external carotid artery was occluded by coil embolization with Tornado coils (Cook, Inc) through the tines of the stent, with cessation of bleeding (Fig 3). There were no systemic signs of infection; however, cultures obtained from the draining neck

Fig 3. Selective left carotid arteriography revealed two pseudoaneurysms at the proximal external carotid artery. The external carotid artery was occluded by coil embolization through the tines of the stent, with cessation of bleeding.

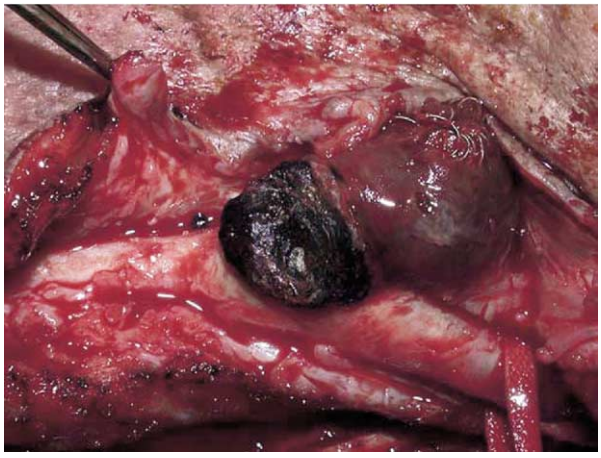

Fig 4. Operative dissection at the time of left carotid resection and reconstruction using a saphenous vein interposition graft. The pseudoaneurysm had eroded to the skin surface, causing a carotid-cutaneous fistula. Note the coils present in the thrombosed external carotid artery. Minimal soft tissue was present, and a pectoralis myocutaneous flap was necessary for coverage.

wound were positive for β-hemolytic streptococcus, and appropriate antibiotic therapy was initiated.

During preparation for surgical left neck exploration, the patient had recurrent sentinel bleeding from his neck wound. He underwent resection of the left carotid bifurcation, including the indwelling stent and reconstruction of the LICA using a saphenous vein interposition graft. At time of operation, the pseudoaneurysm had eroded to the skin surface, causing a carotid-cutaneous fistula (Fig 4).

The dissection was tedious, as tissue planes were fibrosed with significant radiation-induced scarring of the soft tissue at the carotid bulb. The distal aspect of the external carotid artery was oversewn. The saphenous vein graft was sewn end-to-end to the common carotid artery and end-to-end to the internal carotid

artery with a satisfactory anatomic result. Electroencephalographic (EEG) monitoring was used throughout the procedure, and no abnormalities in EEG activity were noted during internal carotid clamping. A pectoralis myocutaneous flap was used to cover the soft tissue defect in the neck, with a good functional and cosmetic result.

Carotid clamp time was 35 minutes, and total operative time was approximately 6 hours. Approximately 600 mL of blood was lost. Wound cultures at the time of operation grew methicillin-resistant *Staphylococcus aureus,* and broad-spectrum antibiotic therapy was maintained. No evidence of carcinoma was found in the pathology specimen.

The patient had a prolonged recovery in the hospital primarily secondary to pharyngeal dysphagia and aspiration. He required a percutaneous gastrostomy for feeding and was discharged to a nursing facility. He died suddenly at home 3 months after the procedure from a presumed cardiac event.

DISCUSSION

Recent interest in endovascular therapy for carotid stenosis has led to widespread use of this modality in the treatment of high-risk patients. Early reports indicate a short-term safety profile that is similar to carotid endarterectomy; however, long-term data are currently unavailable. CAS is particularly appealing in patients with a history of neck radiotherapy and woody induration of the neck, given the technical challenges of carotid endarterectomy and the potential for cranial nerve injury. It has been used selectively in this patient population, with satisfactory short-term results.[7,8]

Radiation-induced carotid artery stenosis is a well-described clinical entity.[4,5] The damage induced by radiotherapy is believed to be a combination of direct vessel wall injury leading to intimal proliferation, necrosis of the media, periadventitial fibrosis, and accelerated atherosclerosis.[2] Indirect effects result from obliteration of the adventitial vasa vasorum. Tissue planes in irradiated fields are less distinct, and the severe scarring and fibrosis following radiotherapy results in a more tedious dissection, with risk of injury to cranial nerves and adjacent structures.

With improvement in long-term survival of patients with head and neck malignancies, carotid stenosis in the setting of neck irradiation is being seen with greater frequency. Radiation injury to the soft tissue surrounding the carotid sheath is variable and appears to be dose related. The appearance ranges from a normal, supple neck to moderate injury and edema to severe fibrosis.[4] Patients with woody induration of the neck coupled with previous neck dissection, like this case, or permanent tracheostomy represent a more challenging subset of patients for open revascularization.

Endovascular repair of traumatic injury of the carotid artery has been reported.[9,10] Furthermore, covered stenting of an infected carotid pseudoaneurysm has been reported in a patient with neck radiotherapy and prior carotid endarterectomy.[11] Carotid rupture or blowout is a feared complication of head and neck cancer and its treatment. Endovascular therapy, including coils, detachable balloons, and stents, has revolutionized the emergency treatment of carotid blowout in the setting of head and neck cancer.[12] These options, however, remain a temporizing maneuver to control acute bleeding in most patients.

The long-term durability of endovascular solutions for infected carotid pathology may be limited, secondary to reinfection and recurrent bleeding.[13] Although previously reported, the use of covered stent grafts to treat infected pseudoaneurysms of the carotid artery after CAS may not be ideal. Covered stenting will temporarily halt bleeding, but reinfection of the new prosthetic device coupled with intraoperative embolic complications have been described.[11,14]

The present case illustrates a previously unreported complication with the use of a metallic stent for carotid occlusive disease in the setting of an irradiated neck. The etiology of this patient's condition is unknown. The sequence of symptoms would suggest a primary arterial infection in the setting of a metallic stent that led to pseudoaneurysm formation of the proximal external carotid artery and erosion to the skin surface in a patient with limited soft tissue overlying the carotid sheath. The erosion through the overlying dermal layer resulted in a carotid-cutaneous fistula. The infection may have been secondary to a transient bacteremia or, less likely, secondary to contamination at the original procedure 20 months prior. Another possibility is a skin erosion that caused seeding and arteritis secondary to skin flora.

Also, erosion of the metallic stent through the dermis as the initial inciting event cannot be ruled out, owing to the paucity of soft tissue coverage after the radical neck dissection. Given the inherent functional abnormality of the irradiated dermis in this cachetic patient, the stent may have led to arterial, soft tissue, and dermal erosion. Finally, unrecognized pseudoaneurysm of the carotid bifurcation at the completion of the initial carotid stenting procedure could be an etiology. This seems unlikely, since completion angiography nor serial duplex examinations in the first postoperative year indicated pseudoaneurysm formation.

The development of a pulsatile mass in the neck after CAS, progressive skin ulceration in the neck, or sentinel bleeding requires urgent evaluation and treatment. Patients with head and neck cancer, radiotherapy, and prior neck dissection may be more prone to skin breakdown, infection, or both. As CAS becomes more widely utilized, previously unreported late complications associated with this procedure are likely to become apparent. Continued close follow-up is warranted in patients undergoing CAS.

REFERENCES

1. Steele SR, Martin MJ, Mullenix PS, Crawford JV, Cuadrado DS, Andersen CA. Focused high-risk population screening for carotid arterial stenosis after radiation therapy for head and neck cancer. Am J Surg 2004;187:594-8.
2. Carmody BJ, Arora S, Avena R, Curry KM, Simpkins J, Cosby K, Sidawy AN. Accelerated carotid artery disease after high-dose head and neck radiotherapy: is there a role for routine carotid duplex surveillance? J Vasc Surg 1999;30:1045-51.

3. Abayomi OK. Neck irradiation, carotid injury and its consequences. Oral Oncol 2004;40:872-8.
4. Kashyap VS, Moore WS, Quinones-Baldrich WJ. Carotid artery repair for radiation-associated atherosclerosis is a safe and durable procedure. J Vasc Surg 1999;29:90-6.
5. Rockman CB, Riles TS, Fisher FS, Adelman MA, Lamparello PJ. The surgical management of carotid artery stenosis in patients with previous neck irradiation. Am J Surg 1996;172:191-5.
6. Yadav JS, Wholey MH, Kuntz RE, Fayad P, Katzen BT, Mishkel GJ, et al. Protected carotid-artery stenting versus endarterectomy in high-risk patients. N Engl J Med 2004;351:1493-501.
7. Ecker RD, Donovan MT, Hopkins LN. Endovascular management of carotid artery disease after radiation therapy and radical neck dissection. Neurosurg Focus 2005;18:e8.
8. Houdart E, Mounayer C, Chapot R, Saint-Maurice JP, Merland JJ. Carotid stenting for radiation-induced stenoses: a report of 7 cases. Stroke 2001;32:118-21.
9. Akiyama Y, Nakahara I, Tanaka M, Iwamuro Y, Hayashi J, Harada K, et al. Urgent endovascular stent-graft placement for a ruptured traumatic pseudoaneurysm of the extracranial carotid artery. J Trauma 2005;58:624-27.
10. McNeil JD, Chiou AC, Gunlock MG, Grayson DE, Soares G, Hagino RT. Successful endovascular therapy of a penetrating zone III internal carotid injury. J Vasc Surg 2002;36:187-90.
11. Baril DT, Ellozy SH, Carroccio A, Patel AB, Lookstein RA, Marin ML. Endovascular repair of an infected carotid artery pseudoaneurysm. J Vasc Surg 2004;40:1024-7.
12. Cohen J, Rad I. Contemporary management of carotid blowout. Curr Opin Otolaryngol Head Neck Surg 2004;12:110-5.
13. Simental A, Johnson JT, Horowitz M. Delayed complications of endovascular stenting for carotid blowout. Am J Otolaryngol 2003;24:417-9.
14. McCready RA, Divelbiss JL, Bryant MA, Denardo AJ, Scott JA. Endoluminal repair of carotid artery pseudoaneurysms: a word of caution. J Vasc Surg 2004;40:1020-3.

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